

MEETING WITH THE RENEWABLE ENERGY COORDINATING BOARD

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The views presented here and any opinions expressed are those of the author alone and do not necessarily represent those of the Rhode Island Public Utilities Commission or its Commissioners.

Presentation Topics

- Regional Targets for Renewables and System Challenges
- Wholesale Market Reforms Impacting Intermittent Resources

Regional Targets for Renewables and System Challenges

New England's Renewable Requirements

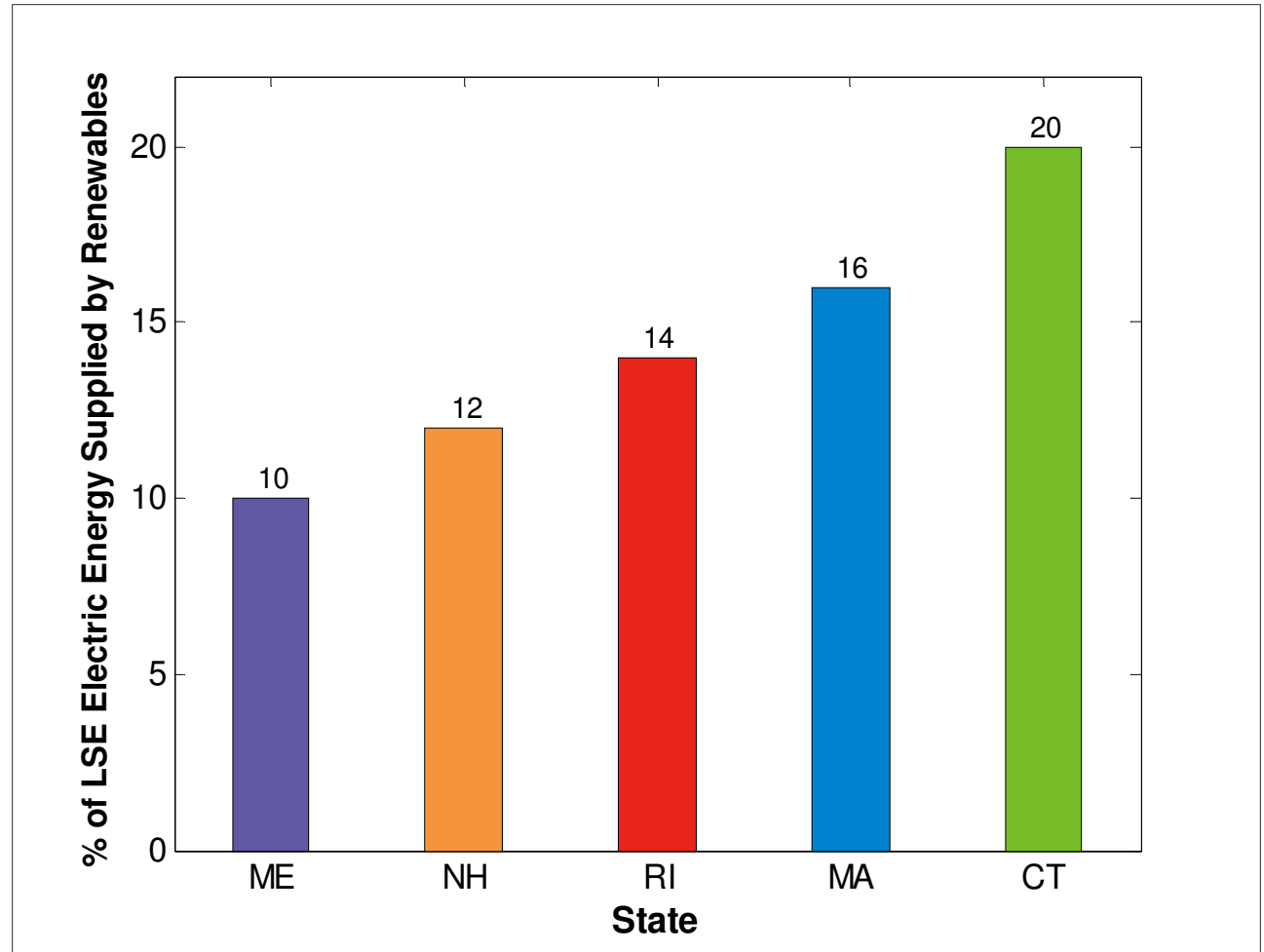
- RES/RPS obligations will continue to increase across New England:
 - RES/RPS mandates generally growing by one percentage point annually
 - Rhode Island – 5.5% New in 2013 (7.5% total)
 - Massachusetts – 8.00%
 - Connecticut – 10.00%
 - New Hampshire – 4.00%
 - Maine – 6.00%
 - Vermont has non-binding goals (20% by 2017)
- In 2015, New/Tier 1 obligations in RI & CT begin to increase by 1.5 percentage points annually
- The RI Public Utilities Commission will open a docket in 2013 to determine adequacy of renewable supplies to meet 2015 targets

New England Renewable Energy Targets, 2021

Today, MA accounts for 46% of the region's total electricity consumption; CT 25%; RI 6%

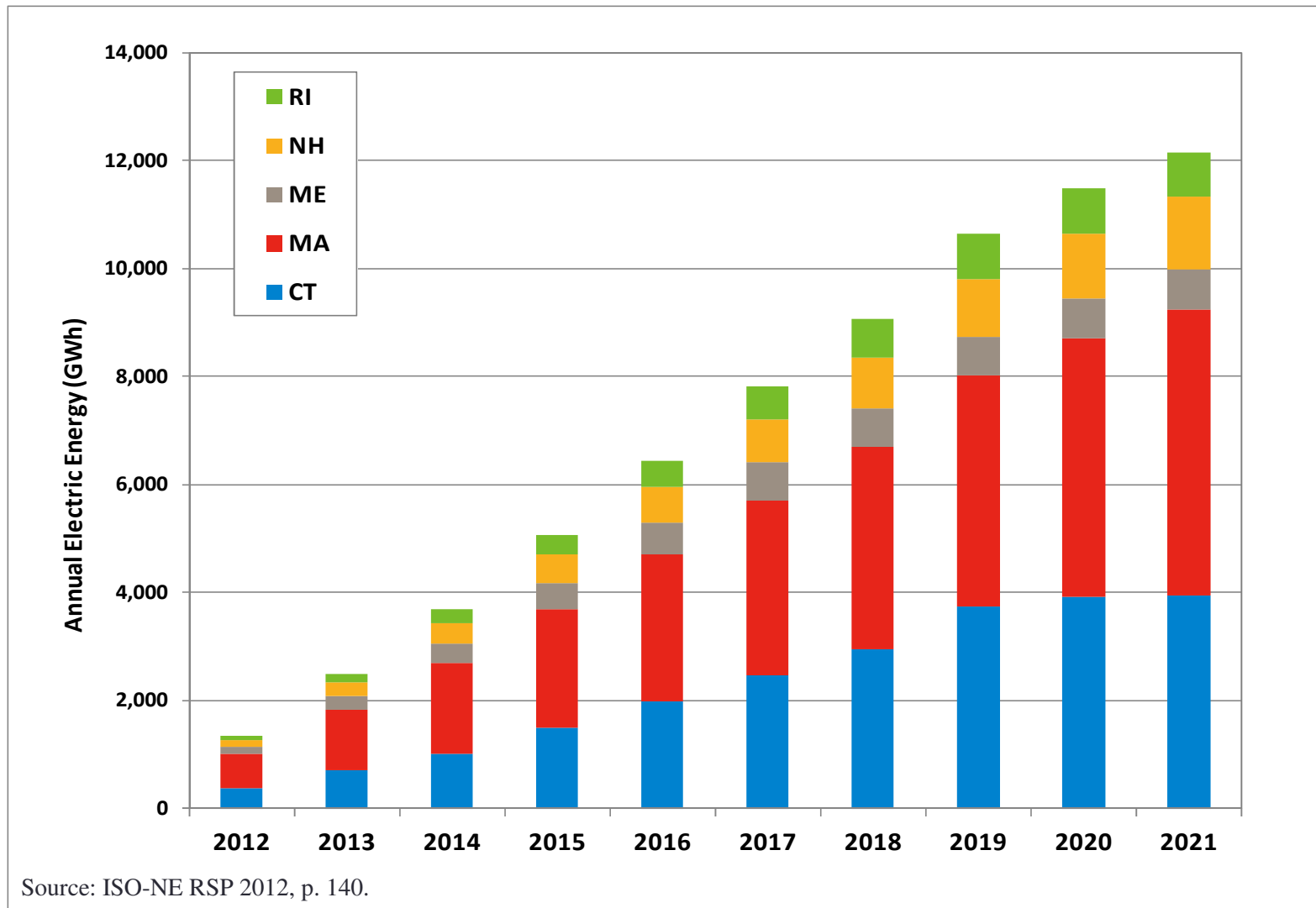
With passive demand response forecasts (11.6% energy reduction in 2021), LSEs would need renewables to provide 20.2% of projected electric energy use to meet existing targets.

By 2021, 31.8% of region's projected electric energy consumption could be met by EE, RPS targets, and related renewable goals.

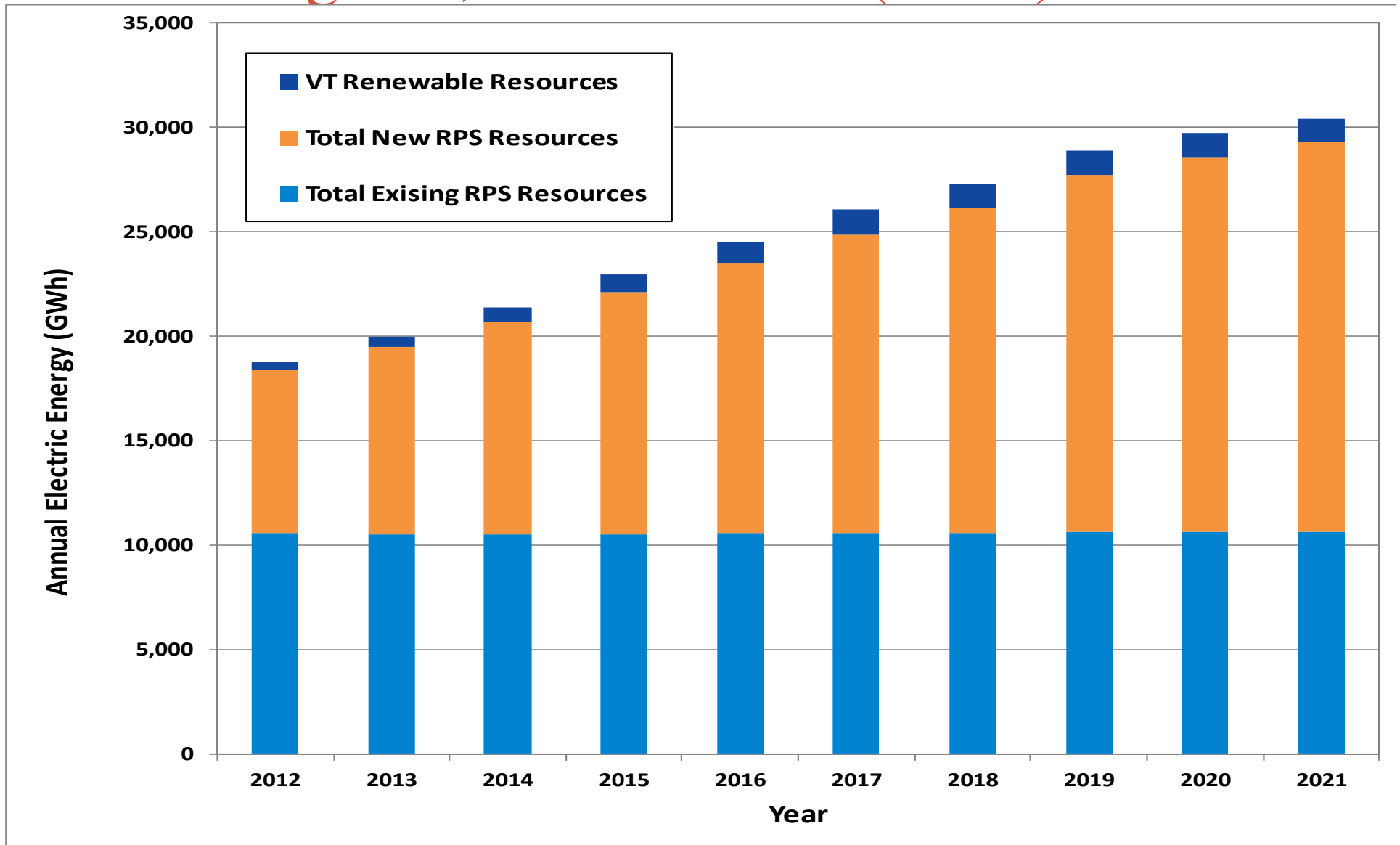


Source: ISO-NE RSP 2012, p. 135, 138-139.

Incremental growth in RPS class targets for "new" renewables, 2012 to 2021 (GWh)



Total Projected growth in RPS targets for New England, 2012 to 2021 (GWh)



Project Development Uncertainty – Summary of Projects in the ISO Interconnection Queue

Project Category	All Projects				Wind Projects ^(b)			
	No.	%	MW	%	No.	%	MW	%
Commercial	87	25	14,432	20	10	12	524	4
Active	72	21	6,974	10	34	42	2,579	22
Withdrawn	193	55	50,821	70	37	46	8,767	74
Total ^(c)	352	100	72,227	100	81	100	11,870	100

- Meeting robust renewable goals is a challenge – but development uncertainty and project attrition have made meeting long-term goals even tougher to achieve.
- 55% of all projects and 70% of potential capacity that have entered queue have withdrawn.
- While the percentage of wind projects withdrawn is less than all projects combined, the percentage of potential capacity has been higher.

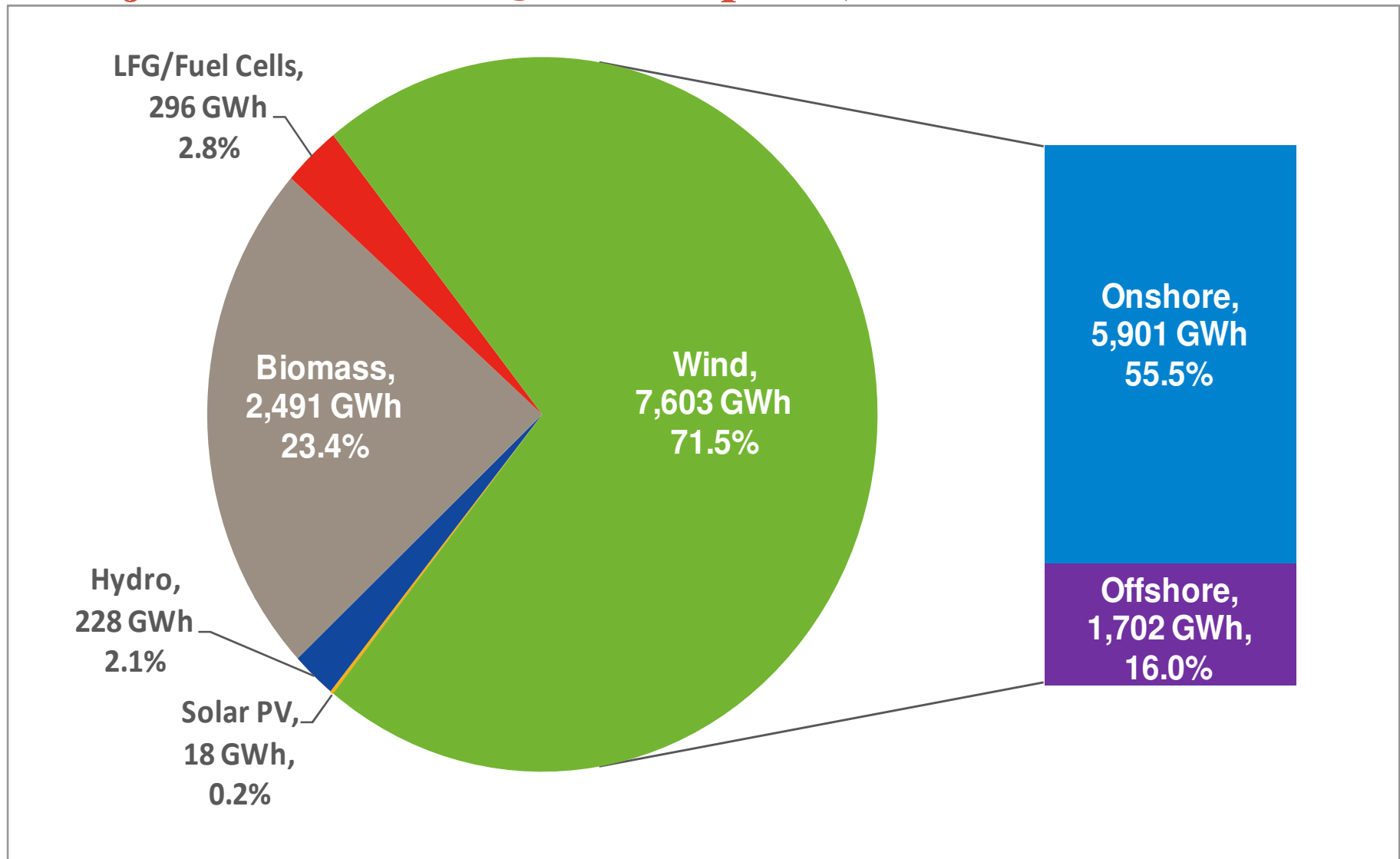
Source: ISO-NE RSP 2012, p. 133. As of April 1, 2012.

Estimated Energy from New England Renewable Energy Projects in the ISO Queue - April 1, 2012

Type (#) of Projects	Size (MW)	Capacity Factor (%)	Estimated Annual Energy Production (GWh)
Hydro (9)	104	25%	228
Landfill gas (1)	28	90%	221
Biomass (9)	316	90%	2,491
Wind—onshore (32)	2,105	32%	5,901
Wind—offshore (2)	474	41%	1,702
Fuel cells (1)	9	95%	75
Solar PV (3)	16	13%	18
Total (57)	3,052		10,636

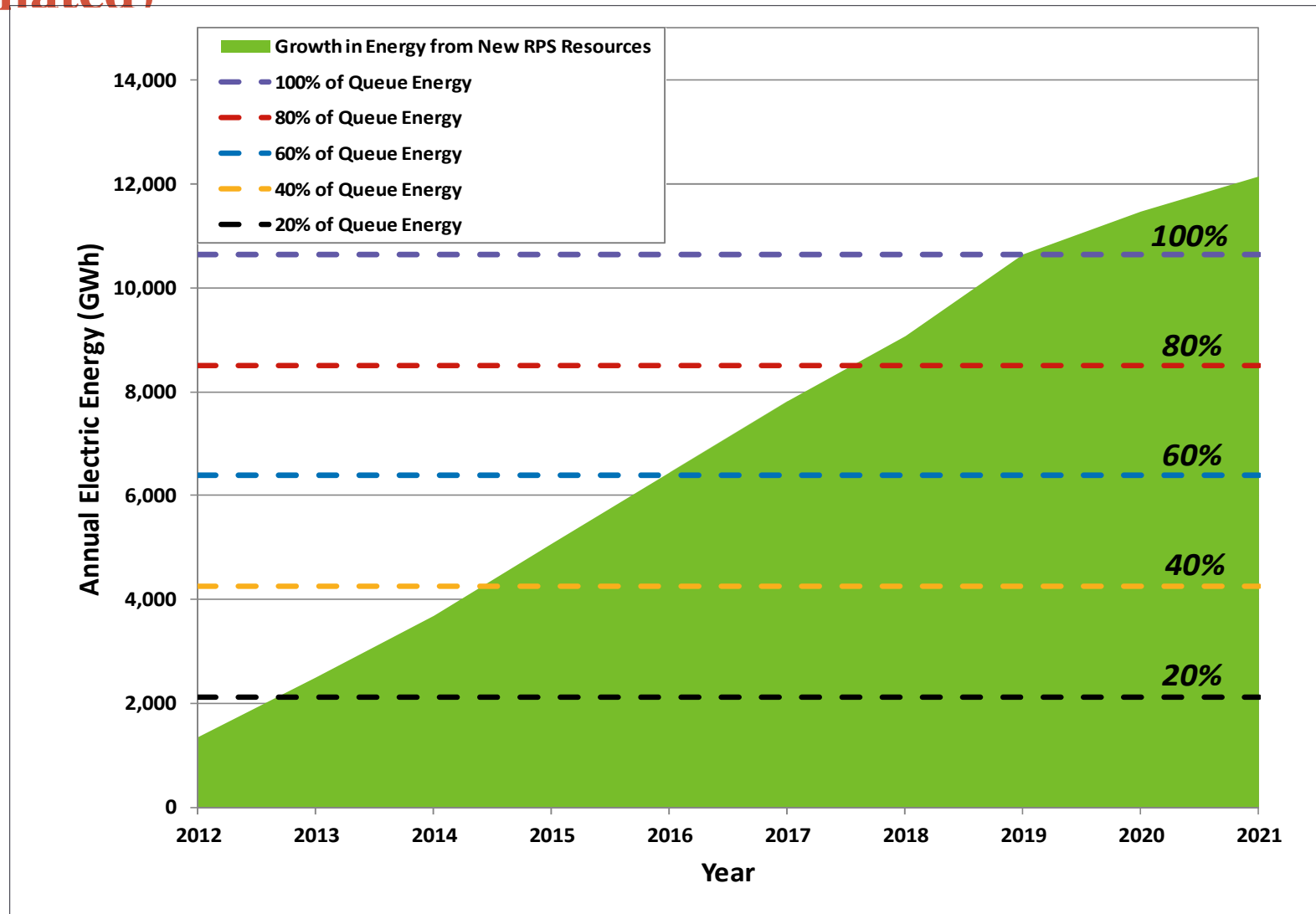
Source: ISO-NE RSP 2012, p. 132. As of April 1, 2012.

Estimated Energy from New England Renewable Energy Projects in the ISO Queue - April 1, 2012



Source: ISO-NE RSP 2012, p. 133. As of April 1, 2012.

Incremental energy from meeting new RPS targets compared with energy from new renewable projects in the ISO queue (estimated)



The Challenge Posed by Greater Levels of Variable Resources

“While low-operating cost renewables (like wind) can potentially increase economic fuel diversity in energy markets...Their Contribution to fuel diversity for reliability is strongly diminished due to their intermittent nature...”

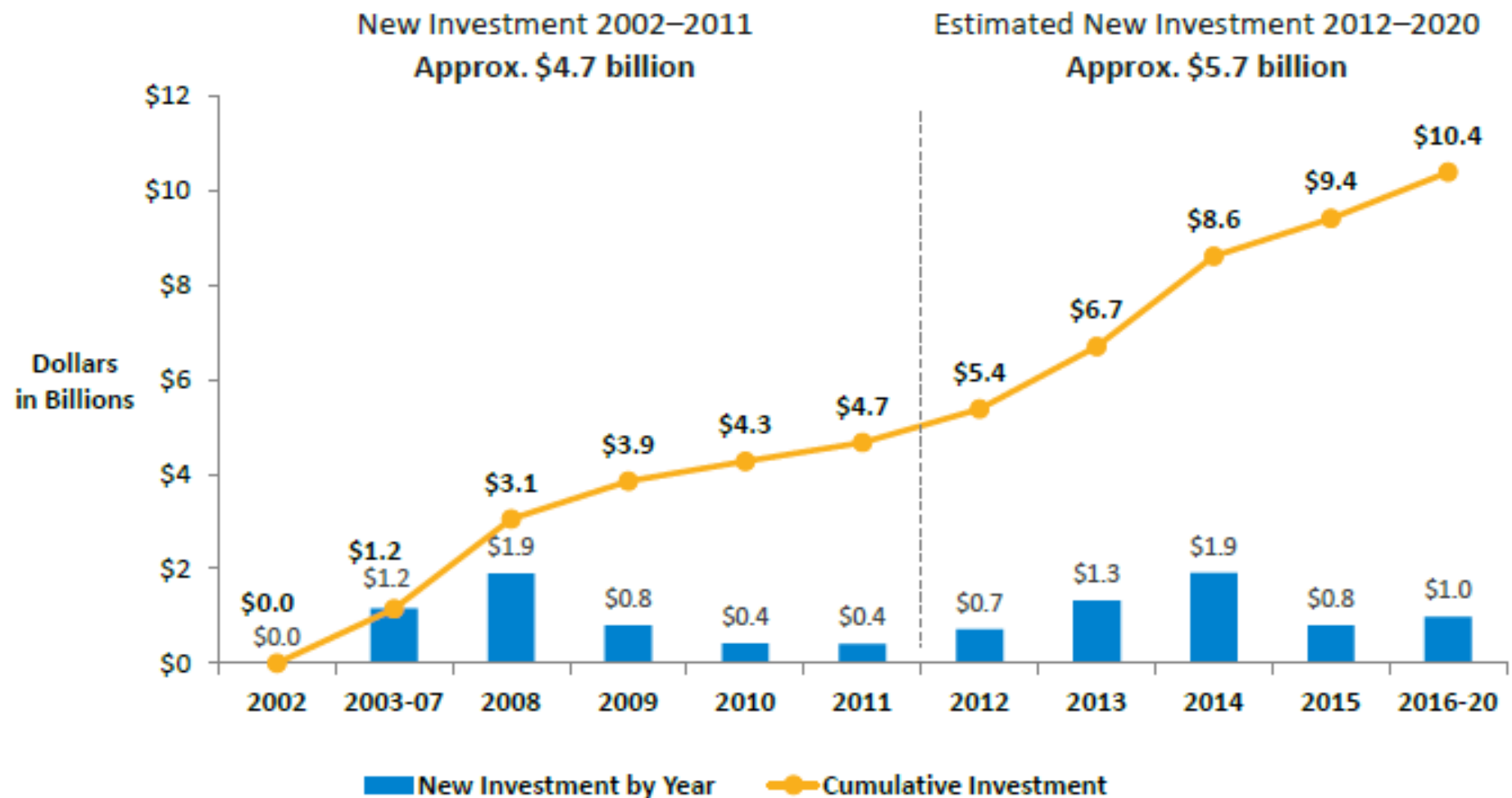
Challenges Posed by Greater Levels of Variable Resources

- Previous slides demonstrated the potential demand across the region for substantial levels of new renewable resources based upon existing mandates and policy preferences
- Along with their environmental attributes, renewable resources can provide greater fuel diversity across the system, but...
- Not all renewables are created equal – either among themselves or in comparison to other fuel-based alternatives
- Offsetting the benefits of fuel diversity are the need for additional reserves and balancing flexibility due to unpredictable performance
- The integration of significant levels of variable resources poses significant challenges to grid operation...and higher costs to the region's consumers.

Examples of Integration Costs – Transmission Only

- ISO-NE's "New England 2030 Power System Study" (Feb. 2010) analyzed various potential scenarios for renewable development
- "Approximately 12,000 MW of potential wind resources in New England could be added to the system..."
- One scenario - 8,500 MW (5,500 MW offshore and inland wind + 3,000 MW Canadian) - could require \$10 billion of new transmission
- 4,000 MWs (2,000 MW inland + 2,000 MW offshore) could meet more than 8% of region's energy needs, but at a cost of \$10.7 - \$14.3 billion in new transmission
- While energy prices could be lower, it "could lead to some generator retirements and a need for additional resources. Other sources of revenue may need to be considered to ensure the economic viability of resources."

Transmission Investment in New England



Source: ISO New England Transmission Project List, through June 2012 Update.

Challenges Posed by Greater Levels of Variable Resources

- The region's aging generation fleet and uncertain performance of demand response resources has increased the need for system operations flexibility – both system wide and locationally.
- As traditional units retire or are too expensive to run, and variable resources increase on the system, the system operator will need more resources that have quick-start capability, fast ramp rates, and are dispatchable across seasons – particularly during summer peaks.
- Wide spectrum of solutions available, some already underway, each with unique costs and complexities. For example:
 - Increase system reserves
 - Enhance performance incentives and penalties in wholesale markets
 - Negative pricing for energy market offers
 - Integrate wind forecasting into commitment and dispatch

Wholesale Market Reforms Impacting Intermittent Resources

Negative Energy Market Offers

- The current energy market floor price of \$0 MWh does not send a strong signal to generators that their output needs to be decreased in periods of low load.
- Since 2009, there have been 160 hours with \$0 LMP
- ISO has proposed an initial offer floor price of -\$150/MWh; could be lowered further after implementation and experience
- From an operations perspective, allowing negative prices would help indicate severity of system conditions and incentivize uneconomic units to shut down.

Negative Energy Market Offers

- In particular, negative energy offers could be utilized by non-dispatchable resources => intermittents and nuclear units
- Could allow renewables to generate electricity and clear market during periods of low load/generation surplus
- Revenue from newly-minted RECs could offset revenue lost in the energy market by a negative offer
- ISO is conducting market simulations and preparing an impact analysis of this and other changes to increase flexibility in the regions wholesale energy markets.
- FERC filing in Q3 2013; implementation in Q4 2014

Real-Time Wind Dispatch

- Wind resources (and other intermittents) are considered “non-dispatchable” by system operators.
- System operator lacks real-time telemetry data resulting in sub-optimal dispatching, particularly in periods of rapidly changing weather conditions
- Resources effectively zero-priced – creating economic inefficiencies and no price separation in congested zones. Cannot set LMPs.

Real-Time Wind Dispatch

- Operators must manually curtail resources to preserve system reliability, regardless of economics
- As a result, wind plants are curtailed more frequently than other resource types – an economically inefficient outcome for both the system operator and resource owners
- “With higher wind penetration, system operators with only manual dispatch & curtailment procedures will be overloaded during dynamic weather conditions...”

Real-Time Wind Dispatch

- Better Forecasting - Require real-time telemetry from wind plants to:
 - Improve operator situational awareness
 - Reduce system uncertainty
 - Improve dispatching and commitment for all resources on the system
 - Make possible “Do Not Exceed” dispatch instructions for wind resources - Each unit will have a dispatching limit reflecting its specific constraints, economics, plant status, and output forecasts.

Real-Time Wind Dispatch – Do Not Exceed

- The DNE Limit reflects the maximum plant output that can be tolerated, given system conditions and constraints
- DNE Limit Includes:
 - Each plant's economic offer curve
 - Maximum output of each wind plant under ideal weather conditions
 - Transmission constraints
 - Each plant's telemetered physical status for the next dispatch interval
 - High-confidence “next 5 minutes” wind output forecasts

Real-Time Wind Dispatch – Do Not Exceed

- A wind plant is free to operate anywhere between 0 MW and the DNE limit; considered “following dispatch.”
- Units following dispatch can set price.
- This dispatching will be voluntary until negative offers can be implemented. Full reliability benefit occurs only when Wind Real Time Dispatch becomes mandatory.

Real-Time Wind Dispatch

- Reduces need for manual curtailments of resources and helps maximize output
- Improves opportunities for wind resources to reduce risk and earn revenue
- Allows intermittent resources to engage in the wholesale energy market consistent with their economic value and facilitates negative energy offers
- Units will have to provide plant and weather data, and submit economic offer curves into the energy markets

Questions?

Thank You!

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